

# Catastrophic health expenditures, government transfers and remittances in Mexico

## Gastos catastróficos en salud, transferencias gubernamentales y remesas en México

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### *Abstract*

This study analyzes pocket health expenditure in Mexico, and the main determinants which make it catastrophic, estimated considering both expenditure and income variables and incorporating government contributions and migrant remittances. It uses data from the Encuesta Nacional de Ingreso y Gasto de los Hogares (ENIGH) 2010 and probabilistic models (logit and probit) to estimate the determinants of catastrophic expenditures and the likelihood of incurring them. The results suggest that insurance status is a determinant of health expenditure, but not of the probability of catastrophic expenditures, while exogenous income has a positive relationship with both determinations.

*Key words:* Catastrophic health expenditure, government transfers and remittances.

### *Resumen*

Se analiza el gasto de bolsillo en salud en México y los principales determinantes que lo convierten en gasto catastrófico. Se consideran tanto variables de gasto e ingreso de las familias, distinguiendo de los ingresos los subsidios gubernamentales y remesas de los migrantes. Se utilizan datos de la Encuesta Nacional de Ingreso y Gasto de los Hogares (ENIGH) 2010 y modelos probabilísticos (logit y probit), para estimar los factores determinantes de la probabilidad de incurrir en gastos catastróficos. Los resultados sugieren que la condición de aseguramiento es determinante del gasto en salud, pero no en la probabilidad de gastos catastróficos, mientras que los ingresos exógenos al hogar tienen una relación positiva en ambas determinaciones.

*Palabras clave:* Gastos catastróficos en salud, transferencias gubernamentales familiares, remesas.

## INTRODUCCIÓN

**E**conomic theory establishes that good health is a vital factor of economic growth; and, on the contrary, an ailing health is a major obstacle for economic dynamics and social development. The role of health as a decisive component of the development of human capital, and as potential factor for economic growth and development has been researched by the likes of Grossman (1972), Schultz (1961), and Fogel (1994), among others. These studies highlight the importance of health for human capital, and the advantages of health expenditure, because a healthy population is essential for production, and improvements in health and nutrition contribute to income accrual.

According to the Official Health Information Standard, pocket expenditure is understood, in a broad sense, as all expenses originated from the payment of services, goods, therapeutic devices, and other useful goods or services for the reestablishment, or improvement, of the health of individuals, or human groups. This definition also includes private or public social security payments.

On the other hand, it is considered that health expenditure becomes catastrophic when families have to reduce their basic expenditure during a certain period of time in order to cover the cost of healthcare.

Currently, more than 50% of the total health expenditure is private; and more than 90% of it comes directly from the family budget. Many Mexican households continue to pay for medical services and medicines from their own pocket, at the moment they need them. This situation denotes a problem that is not only related to economic inefficiency, but also to social injustice, because it shows faults in a public health system, whose intrinsic objective, according to Murray et al. (2000), is to reach justice in the funding of sanitary services<sup>1</sup>. Given the prevailing poverty levels in the country, where 52% of the population lives in conditions of asset poverty (CONEVAL, 2012), the fact that 45% of the total health expenditure comes from the family budget calls into question the amplitude of healthcare service covering, because it compromises the budget of poor families

<sup>1</sup> Prepayment and grouping of financial risks in big funds are options for an efficient funding (Frenk *et al.*, 1994).

by forcing them to directly pay for healthcare; and it also compromises the quality of the services they could receive, given their low income levels.

The objective of this paper is to analyze health pocket expenditure in Mexico, and the main factors which make it catastrophic for families, based on the framework developed by the World Health Organization (WHO). As it has been done in other studies, this paper considers both the perspective of income and private expenditure to estimate the amount of catastrophic expenditure, as proposed by Xu et al. (2003). Simultaneously, this paper evaluates governmental contribution, as well as remittances that families receive from relatives living abroad, with two particular purposes. The first is to clarify the amount of public health financing, hidden among governmental subsidies; and second, to highlight the role of remittances in healthcare covering for the receiving families.

This investigation seeks to assess whether if insurance is a decisive factor in catastrophic health expenses, because the escalation and magnitude of economic problems related to healthcare costs seem to contradict the guarantee of coverage of health service costs by the public health system, evidenced by the fact that insured families incur higher per capita healthcare expenses than non-insured families; and, at the same time, it seeks to raise awareness of this situation through economical and demographic considerations, and to establish the possibility of families incurring catastrophic expenditure because of their income level, by itemizing income sources. This allows to determine the ratio at which are related the health expenditures and economic contributions that Mexican families receive from the government, or relatives living abroad, As noted in the extant literature, catastrophic expenses are explained by insufficient healthcare coverage; but that relationship is controlled by a series of other variables related to demographical aspects, and to the income level of Mexican families. Besides, it can be assessed by itemizing family income, making a distinction between governmental monetary funding, and remittances coming from emigrant relatives.

This work is organized in four sections. The first section summarizes the political model of public expenditure growth that supports the evaluation of the estimated results. The second section presents the research methodology used; and the third analyzes research supported by descriptive statistics of the main relationships shown by the household sampling included in ENIGH 2010. The fourth section includes the estimated results, and a result contrast. Finally, this paper counts with a section of conclusions. In general, results suggest that insurance reduces healthcare expenses, but

there does not seem to be any determinant relationship between insurance and the probability of familial catastrophic expenses.

It can be concluded from the political balance model that these results suggest that there is an insufficient balance between public healthcare expenditure and its tax cost, determined by the average income, to cover the popular demand for healthcare services.

### **THEORETICAL ELEMENTS HEALTH AND ECONOMIC GROWTH**

The link between health and income has been described as a gradient that reveals a causal relationship between income and health level; this is, health levels improve with an increase in income, all along the distributive structure. But this relationship is not linear because, as Deaton (2002) explains, the marginal reduction of mortality rates per additional income unit is higher at the lower part of the economic structure than in the upper part. Therefore, there is a marginal decreasing relationship between income, health, and the maximum expression, which is the mortality rate. Often, health level differences are also correlated with other variables, such as ethnic group, geographical location, occupation, status, socioeconomic conditions, etc.; and these concepts are frequently described as “healthcare inequality” (Kawachi et al., 1999).

A line of reasoning that seeks to explain the relationship between health and income distribution highlights the importance of socioeconomic level for the determination of health conditions; others underscore the effect of health over income accrual, a two-way (or double causality) relationship, known in health economy literature as “reverse causality” (Goldman, 2001). Some studies also (Deaton, 2002) address the role of behavioral patterns (such as the consumption of tobacco, alcohol, drugs, sex, etc., which clearly affect population morbidity and mortality) which have an undetermined relationship with income. In any case, health levels play an obvious role in the determination of physical capabilities (such as strength and resistance) and mental capabilities (such as cognitive function, reasoning ability, intelligence, etc). Thus, health is important for human capital (Schultz, 2005), but the correlation between health levels and economic prosperity remains debatable. It has seen as a reflection of the causal link between income and health levels (Deaton, 2002); demonstrating the close relationship between global health indicators, such as life expectancy, child mortality or survival rates, and per capita income (Preston, 1975).

In contrast, Acemoglu, Johnson and Robinson (2002) doubt that health level improvement is a main determinant of economical growth, and disre-

gard the proposed thought that unfavorable health conditions are the cause of the spread of poverty in certain countries. In Mexico's case, Mayer-Foulkes (2001) study of the relationship between health and growth, which uses health indicators (such as life expectancy and mortality rates across different age groups), suggests that health was the cause of approximately one third of long-term economical growth achieved in the 1970-1995 period; and concludes that, for each one-year increase in life expectancy, income grows between 2% and 4%.

### **The political model of public expenditure growth**

If we start from the premise that health is a public asset, and that, consequently, the State has to finance the population's demand for healthcare services, then catastrophic pocket expenses arising from this concept is an expression of an insufficient State public healthcare offer.

Public sector theories analyze the reasons for this sector's existence, and try to create a theory that explains its increase in size, and the itemization of its expenditure. The political model of public expenditure growth (Hindriks and Myles, 2006) is an application of the median voter theorem to public good provision. This theorem, like other political economy tools, seeks to explain consumer and social wellbeing as a function of the reception of public benefits; but, at the same time, it recognizes that these public benefits come from the tax burden paid by society. However, in an heterogeneous society, the relationship between received benefits and paid taxes is asymmetrical across the different groups that integrate such society. Some groups pay more taxes, and receive less benefits; while others pay less taxes, and receive more benefits. It is assumed that the median income group represents an equilibrium between the cost of paying taxes, and the benefits obtained from public expenditure.

The addition of preferences among that heterogeneous society is done under the assumption that those who benefit from public assets seek to maximize public expenditure, and raise tax rates; on the other hand, those affected by the tax burden prefer to reduce public expenditure, in order to reduce said tax burden.

The model of Hindriks and Myles (2006) starts from an economy with an H-amount of consumers, whose income falls within a range between a minimum 0, and a maximum  $y$ . The government provides public goods, financed by the proportional use of tax income.

The function of government-financed public good utility is:  $u(t,G) = (1 - t)y_i + b(G)$  (1)

Where  $t$  is the tax burden, and  $G$  is the level of public good provision. The  $b(\cdot)$  function is the benefit obtained from the public good, and it is increasing and concave -thus, marginal benefit is positive, and decreasing. Utility depends on the tax burden, and the government expenditure level; and it is equal to the available income (or net income after taxes) plus the benefit obtained from public expenditure.

The function of individual consumer utility is:

$$\mu_i(G) = \left[ 1 - \frac{G}{H\mu} \right] y_i + b(G) \quad (2)$$

The optimization of the level of public good provision is given by the following first-order function:

$$\frac{\partial \mu_i(G)}{\partial G} = -\frac{y_i}{H\mu} + b'(G) = 0 \quad (3)$$

The demand of public goods by consumers depends on the relationship between their income and the median income, because the latter determines marginal income. These results are consistent with those obtained through the median voter theorem. According to Acemoglu (2009), when all voters have a preference between two options, given a certain political alternative order, the winner of the election always coincides with the median satisfaction point of the ranking of possible results. This same result is obtained with any election method chosen; whether direct democracy, sincere voting, or open agenda (Acemoglu, 2009),

In this model, political balance is determined by the average voter, because the marginal benefit of an additional unit of public goods provided by the State is equal to the income of the average voter, in relationship with the median income. Given that marginal benefit decreases as public good provision increases, the level of political balance of public goods increases with income inequality, measured by the ratio between the median and the average income.

## Methodology

The methodology used consists in a to-stage analysis; the first is to try to determine the factors that explain the increase in health expenditure. The second is to determine the variables that explain the catastrophic expenses, using a probabilistic model. Some commonly-used demand indicators, according to the work of Magrabi et.al. (1991), are the sociodemographic characteristics of individuals and families. Following the proposal of Kn-aul and Frank (2005), a censored Tobit model was designed to identify the main variables that explain familial expenses on health products and services; and a Probit model to specifically explain the probability of a family incurring in healthcare expenses over 30% greater than their available income (that is, catastrophic expenditure). The data on which this analysis is based come from the Encuesta Nacional de Ingresos y Gastos en los Hogares (ENIGH) (National household income and expenditure survey), carried out by INEGI. The study comprises households all across the country, the survey has nationwide representativity, and contains detailed information of the different types of income and expenses, as well as important socio-economical and demographic characteristics of a wide range of households.

As in the first model, the dependent variable is continuous in the uncensored part, and discrete in the censored part. The relationship between the vector of explanatory variables and the dependent variable is non-linear; thus, the Tobit model is adequate for the estimation. In this model, the censored variable  $y$  has a continuous part (for  $y^*$  values equal, and lower, than 0), which generates a non-linear relationship between the dependent variable and the explanatory variables. The regression coefficients are the marginal effects of the latent variable; this is, the regression coefficients, and the marginal effects of  $y^*$  are identical.

In the model that estimates the probability of incurring in catastrophic expenditure, it is assumed that such expenditures occur when health expenses reach a proportion equal, or higher, than 0.3 of the total household expenditure (OMS, 2000). This condition is exacerbated by the absence of familial insurance; which forces the families to directly cover the economical consequences of an illness and, at times, these expenses cause the loss of an important part of their patrimony, or debts. These events force families to substitute some general expenses, which results in changes of their consumption patterns. Therefore, the probability of incurring in catastrophic expenditure depends on insurance; that is, whether the individual is registered in the national healthcare system, plus a series of typical social, economical or demographic characteristics, such as the proportion of

children and elderly adults, due to the fact that their health is more delicate than that of other age groups. Other important factors are the family assets, place of residence, etc.

Probit is used to model the probability of catastrophic expenditure, because a dichotomous dependent variable is required. A Probit model whose estimators would explain the probability of families incurring in health expenditure that is higher than 30% of their available income. The dependent variable in Probit models is dichotomous, and the estimation model is produced by a normal cumulative distribution function and, consequently, it requires the method of maximum likelihood.<sup>2</sup>

Delimitation of the dependent variables of both models;

- Dependent variable of the censored Tobit model:  
Only considering the Expenditure variable:

$$Y_j = \frac{(\text{Total health pocket expenditure})_j}{(\text{Total expenditure})_j - (\text{Food expenditure})_j}$$

Considering the Income variable:

$$Y_j = \frac{(\text{Total health pocket expenditure})_j}{(\text{Total expenditure})_j - (\text{Food expenditure})_j}$$

- Dependent variable in the Probit model;  
Only considering the Expenditure variable:

$$\text{Catastr} = \begin{cases} Y_j = 1 & \text{if total health expenditure} = 30\% \text{ of available income.} \\ Y_j = 0 & \text{if total health expenditure} < 30\% \text{ of available income.} \end{cases}$$

Considering the Income variable:

$$\text{Catastr} = \begin{cases} Y_j = 1 & \text{if the total health expenditure} = 30\% \text{ of the available income.} \\ Y_j = 0 & \text{if the total health expenditure} < 30\% \text{ of the available income.} \end{cases}$$

<sup>2</sup> The Ordinary Least Squares method is ineffective, because, in some cases, the probability foreseen by this model are lower than zero, and greater than one, which violates one of the axioms of probability theory.

The explanatory variables are the same for both models, and they are the most commonly used variables in this kind of analysis:

- a) *Insurance* = dichotomous variable (1= At least one insured family member, 0= No insurance).
- b) *Women* = number of women of childbearing age (15 to 45 years old) living in the household.
- c) *Sex* = dichotomous variable (1= the head of the household is a man, y 0 = it is a woman).
- d) *Age* = Age of the head of the family.
- e) *Educational level* = level education of the spouse of the head of household.
- f) *Number of children* = number of children from 0 to 5 years old living in the household.
- g) *Number of elderly adults* = People older that 65 years old.
- h) *Seguro Popular (Mexican public insurance scheme)* = dichotomous variable (1 = Any member registered, 0 =None).
- i) *Solid floor* = dichotomous variable (1 = the household counts with a solid floor, or 0 = Not).
- j) *Solid roof* = dichotomous variable (1= Solid roof, 0 = Not).
- k) *Access to drinking water* = dichotomous variable (1 = Yes, 0 = No)

This basic model was adjusted in this study to try and demonstrate the importance of income sources other than the income generated from the families themselves, or the household heads, for the financing of healthcare services. The fundamental criteria of considering the expenditure item to measure the catastrophic expenditure indicator had to be modified. In its place, the study used the income variable, and compared health expenditure with the quotient resulting from monetary income minus food expenses. Considering income, instead of expenditure, allowed the differentiation of its sources, to subsequently estimate net income by subtracting governmental contributions to total income; and by deducting money remittances, and adding governmental contributions. The probability of catastrophic expenditure was calculated with these results, considering three types of income: total income (I), net governmental contributions (II), and net governmental contributions plus remittances from relatives living abroad (III).

The first finding of this study was a hidden portion of governmental contributions, which is truly destined to healthcare expenses; consequently, the public financing statistics have to be complemented with this portion of governmental aid in the different government programs at the national,

state and municipality levels. The beneficiaries of these programs use government contributions for illness treatment, medical consultations, and other types of health expenses; and thus, they avoid incurring in catastrophic expenses. The same happens in the case of remittances from abroad, a concept that particularly refers to money sent by migrant workers to their families in Mexico, and which may be largely motivated by chronic illnesses or diseases of the latter.

Additionally, the estimation of catastrophic expenses from income facilitated the calculation of the descriptive statistics, considering the distributive structure in income deciles, in order to connect health expense behavior across different social strata.

### **Catastrophic health expenditure**

For the analysis of the direct cost of illness, Xu et al. (2003) propose the concept of financial contribution to express the financial burden imposed on families by the healthcare system. This capacity to pay is defined as the effective income of families minus subsistence expenses. To estimate effective income, Xu et al. (2003) take family consumption, because its variance is less than variance in current income.

The definition of catastrophic expenditure varies according to the percentage attributed to pocket expenses, in relation to the total amount. There is great variance in the proportion that pocket expenses must represent for the expenditure to be considered catastrophic. For example, for Xu et al. (2003); the threshold is 40%; and it is 10% in other studies.

There is a positive relationship between the proportion of families incurring in catastrophic health expenditure and the percentage of pocket expenses in the total health expenditure. This means that the possibility of deficit in health expenses increases when families self-finance these costs. This is another way to say that insurance may exempt people from excessive expenditure in healthcare.

Given the fact that catastrophic expenses occur when direct payments from families form a high proportion of the total healthcare expenditure, the probability of catastrophic expenditure is expected to increase when poverty levels and the need for healthcare are greater (Xu et al., 2003). In turn, Wagstaff and Van Doorsaler (2002) present and compare two measurements of equality on healthcare payments. The first requires the payments to not exceed a proportion of the income specified *ex ante*; and the other requires that families do not be driven to poverty by them. For this, they develop indices to establish how “catastrophic” are pocket health

expenses, capturing magnitude, impact, and variation related to income. In one hand, they suggest the achievement of the sample fraction whose health expenditure is proportionally larger than a (theoretical)  $z$  threshold, calculating the proportion of population that incurs in catastrophic expenditure. “Excess” catastrophic expenditure is also analyzed, capturing the severity of the expenses. Concurrently, in relatively poor countries, an increase of pocket expenditure can lead to what scholars term “the poverty trap”, stressing the economical consequences of illness.<sup>3</sup>

The results of recent studies estimating catastrophic expenses through the standard methodology are systematized in the work of Díaz Aguirre (2011). According to the estimations of these studies, since the year 2000, over 5% of Mexican households have incurred in catastrophic expenses, with the exception of 2002 and 2008. Knaul y Frenk (2005) estimated that, in the space of three months, 6.3% of Mexican households incurs in catastrophic or impoverishing expenses. On the other hand, Urquieta-Salomón, et.al. (2008) compared the effect in pocket expenses of households with disabled members, or members with limitations to perform moderate daily activities, and found that such limitations significantly increase pocket expenditure, but not not disabilities.

The analysis of familial catastrophic health expenditure is shown in Table 1. The first column presents the percentage of health expenses considered critical for the family budget, which is 30%; it also presents a below 0 category, which comprises observations in which the quotient of health expenditure and total net food expenditure gives a negative result. Households where the total income is greater than the equivalent food expenditure—due to self-consumption, to which the ENIGH assigns a monetary value—, but whose members also spend on concepts related to healthcare. The sum of observations of both concepts is the total of households incurring in household expenditure.

Table 1 shows that 48.5% of the 29 million households surveyed by ENIGH (which means 14 million households), reported the expenditure of part of their budget in concepts related to healthcare. Considering total income (type I), 745 000 households incurred healthcare expenses amounting to more than 30% of their net income for food; and 536 000 households had health expenditure, even though their net income was insufficient. In total, 1 280 678 households report critical health expenses.

<sup>3</sup> Normally there are weak points in the measurements of catastrophic expenditure. In general, information sources do not take into account indirect expenses, such as transport, food, or income losses due to illness, underestimating the financial consequences of pocket expenditure.

Table 1: Results of the catastrophic expenditure estimate considering the Income variable (Type I, II and III)

	Income I	Income II	Income III
Total households	29,074,332		
Households with healthcare expenses	14,105,718		48.5%
Households incurring in catastrophic expenses			
Healthcare expenditure/net income			
>0.30	745,096	737,256	730,310
<0.0	535,582	1,232,120	1,413,427
Suma	1,280,678	1,969,376	2,143,737
<i>Proportion of the total number of households</i>			
Healthcare expenditure/net income			
>0.30	2.6%	2.5%	2.5%
<0.0	1.8%	4.2%	4.9%
Total	4.4%	6.8%	7.4%
<i>Proportion of households reporting healthcare expenses</i>			
Healthcare expenses/net income			
>.30	5.3%	5.2%	5.2%
<0.0	3.8%	8.7%	10.0%
Suma	9.1%	14.0%	15.2%

Source: Compilation based on information from ENIGH, 2010.

Table 2: Distribution of economic variables related to healthcare expenses

GC=	Health/(food-income) %	Factor/ Families	Current income	Monetary expenditure	Alimentos	Salud	Simple average Health/(food income) %
0		538,316	8,792.3	15,230.9	8,123.1	566.4	0.8464
0.1		11,540,797	41,112.9	27,975.3	8,736.8	642.8	0.0199
0.2		1,132,410	34,524.9	28,580.2	8,608.9	3,093.2	0.1194
0.3		353,153	26,017.5	23,480.5	7,245.3	3,548.5	0.1890
0.4		187,745	24,533.2	20,420.9	6,624.2	4,147.6	0.2316
0.5		147,059	26,249.6	28,193.8	7,767.7	6,116.8	0.3310
0.6		96,060	23,436.7	25,693.5	8,224.0	6,177.5	0.4061
0.7		67,299	22,713.3	27,933.5	7,420.2	7,828.1	0.5119
0.8		43,153	19,989.5	23,613.5	7,317.5	6,760.9	0.5335
0.9		25,493	14,410.3	19,973.0	6,430.6	5,925.9	0.7426
1		196,793	17,598.0	28,173.4	6,982.8	11,380.6	1.0721

Source: Compilation based on information from ENIGH-INEGI, 2010.

This figure increases to 1 969 376 households if government contributions are excluded; and to 2 143 737 if remittances are also excluded. It is worth noting that catastrophic expenditure increases 54% from type I income to type II; and, from type II to type III, it increases 67% of its incidence in type I. Firstly, these findings reveal the precariousness in which many Mexican families live, and second, the importance of governmental contributions and remittances in the familial income. Without that income, many families would be incapable of financing healthcare services, regardless of their cost, and the probability of catastrophic expenditure would be higher.

The incidence of catastrophic expenditure in families is of 9.1% of 14 million households that make expenses on healthcare; but it would reach 15.2% without governmental contributions and remittances from abroad. Regarding the total number of households, the proportion would be 4.4%; and it would increase to 7.4% without government contributions or remittances from abroad.

The consideration of income also facilitates the organization of the information, in order to reveal significant quantitative relationships about families incurring in healthcare expenses, seen in Table 2. This table shows organized information from catastrophic expenditure deciles, to try to identify irregularities in households that incur in this kind of expenditure. Firstly, it highlights the fact that current income level of these households reveals that the probability of incurring in catastrophic healthcare expenditure is not an income problem.

The factors that determine the probability of this kind of expenditure are, the presence of any illness or disease requiring hospital care that compromises the family budget, combined with the lack of medical insurance. As evidenced in Table 2, these conditions are present for any income level.

The highest level of quarterly income corresponds to those who incur in less than 10% of catastrophic expenditure (second decile), and the lowest income corresponds to those whose healthcare expense percentage is below zero. Also, these groups reported the least absolute healthcare expenses (see column 6).

From this table we can infer some interesting stylized facts for the debate on healthcare financing. The largest catastrophic expenditure is seen in the first decile (84.64%), only slightly surpassed by the last decile, whose CI average is greater than 100%.

Source: Compilation based on information from ENIGH-INEGI, 2010.

Healthcare expense	Sex (F=1,M=2)	Age of head of the household	Formal education	People in the household	Men	Women	Elderly	Children
0	1.242	48	4	4	2	2	3	1
0.1	1.238	48	6	4	2	2	3	1
0.2	1.280	51	5	4	2	2	3	1
0.3	1.280	50	5	3	2	2	3	1
0.4	1.294	51	5	4	2	2	3	1
0.5	1.287	54	5	3	2	2	3	1
0.6	1.364	52	5	4	2	2	3	1
0.7	1.343	55	5	4	1	2	3	1
0.8	1.171	57	4	3	1	2	2	1
0.9	1.160	53	4	3	2	2	2	1
1	1.290	54	4	3	2	2	3	1

Table 3: Frequency of sociodemographic variables related to healthcare expenses

Catastrophic expenses are not dependent on income level, neither positively nor negatively. Higher-income families tend to avoid catastrophic expenditure; while lower-income families have a high probability of incurring in this kind of expenditure, which probably depends more on the lack of medical and hospital services, and the cost of medicine or therapeutic treatment, than on the absence of a protection system. Nevertheless, public healthcare covering determines whether this group incurs catastrophic expenditure or not.

Similarly, as shown in Table 3, there does not seem to be any clear correspondence between the level of healthcare expenses and some of the most important sociodemographic variables, such as the sex of the head of the household, their age, the number of people in the household, or the presence of men, women, elderly people or children; at least considering the level of aggregation adopted in this statistical model. As can be seen hereinafter, this explains the low result, or lack of statistical significance, of the determination quotient values of some of these variables.

## RESULTS

The estimates from the censored TOBIT model were applied in two variants. The first used all the observations in ENIGH 2010; and, in the second, the estimate was done only with the sample observations that record healthcare expenses. The results are presented in Table 4. Additionally, each one of those variables included two estimates: the first used the characteristic sociodemographic variables of the catastrophic expenditure estimation models, as mentioned above; and the second also included dummy variables to identify the households that receive governmental funds in the form of monetary transfers, and money transfers from abroad, related to remittances sent in by migrant workers.

Upon adjusting the sample size to only consider the families that report healthcare expenses, a change of sign arose in the relationship between the independent variables and the dependent variable. For example, the education level of the head of the household (*Formal\_ed*), the presence of female members, and the dummy variable “Solid roofing” (*Roofing\_*), contribute to the reduction of familial healthcare expenses when we only consider the sample of households which report such expenses, but not when considering all the families that constitute the ENIGH sample.

Table 4: Results of the TOBIT model

Independent variables	Obs. 1-27656 (n = 26578)		Obs. 14088-27656 (n = 13061)	
	Dependant variable: CE		Dependant variable: CE	
	(1)	(2)	(1)	(2)
Constant	-0.08400 ***	-0.08808 ***	0.07211 ***	0.06583 ***
Med. care_D	-0.00834 ***	-0.00808 ***	-0.00703 ***	-0.00686 ***
Seguro pop_D	0.00564 **	0.00461 *	0.00765 ***	0.00624 **
Sex M=1	-0.00434 *	-0.00525 **	-0.00799 ***	-0.00849 ***
Age	0.00099 ***	0.00094 ***	0.00129 ***	0.00120 ***
Formal_ed	0.00191 ***	0.00236 ***	-0.00250 ***	-0.00188 ***
Men	-0.00032	-0.00064	-0.00361 ***	-0.00416 ***
Women	0.00499 ***	0.00441 ***	-0.00102	-0.00192 **
Elderly	-0.00409 ***	-0.00384 ***	-0.00733 ***	-0.00696 ***
Roofing_	0.01791 ***	0.01878 ***	-0.00801 ***	-0.00585 **
Water_	-0.01119 ***	-0.00913 ***	-0.01199 ***	-0.00828 ***
Gover_contrib		0.00814 ***		0.01538 ***
Remittances_		0.02666 ***		0.02253 ***

\*\*\*99%, \*\*95% y \*90% significance level

Source: Estimates based on information from ENIGH-INEGI, 2010.

As can be expected, the first result was that insurance is a key factor to reduce the probability of familial catastrophic healthcare expenditure, both considering the whole population, and only considering those households that reported medical expenses during the survey period. Nevertheless, the opposite occurs when people are affiliated to the Seguro Popular (Seguro\_pop\_D), which contributes to increase the probability of having excessive healthcare expenses. The positive association between affiliation to the Seguro Popular, and a higher probability of catastrophic expenditure can be explained with two ways that complement each other. The first is that it only covers hospital care, but not the cost of medicine, prosthetics or rehabilitation, which forces families to make higher healthcare expenses; the other interpretation, explained by adverse selection, is that the results may be correlated, and the families that usually have healthcare expenses (and thus, affiliate to the Seguro Popular) are exposed to healthcare expenses beyond the specified CE threshold anyway.<sup>4</sup>

Nevertheless, the “Female head of household” variable tends to reduce healthcare costs when we consider both samples; although it is more statistically significant in the second sample. Additionally, healthcare expenses increase with age, and the number of male members in the household reduces healthcare expenses in a more significant proportion only when we consider the group that has incurred in this kind of expenses. Among the elderly, the presence of current water in the household reduces that probability.

Excepting the Seguro Popular variable, up to this point, results show the expected sign for all variables, with sign changes and the loss of statistical significance of some variables when we consider the sample of families reporting healthcare expenses.<sup>5</sup>

Considering the role played by government contributions and foreign remittances in healthcare cost covering offers a different panorama. The impact of monetary transfers increases with the sample change, but its sign does not change: In both cases, governmental monetary aide increases the probability of excessive familial healthcare expenses. Similarly, foreign remittances increase that probability as well, even though the impact seems

<sup>4</sup> The Sistema de Protección Social en Salud (SPSS) (Healthcare social protection system) offers access to subsidized insurance to non-insured families through the Seguro Popular de Salud (SPS). This new system seeks to reduce healthcare catastrophic expenditure, give greater incentives for an efficient healthcare expenditure, and a more equal and affordable healthcare for the entire population (Knaul et al. 2005). According to CEPAL (2006), it is estimated that SPS has had a positive effect over equality and a reduction of 25% in pocket expenditure of low-income families.

<sup>5</sup> It could be an adverse selection, as in risk insurance, in which an ailing person is affiliated to this program, obtains some savings, but continues spending on medicines, for example.

to be reduced when only considering families that already have healthcare expenses. As both variables are related to poverty, this suggests that government contributions and foreign remittances are partly used to cover healthcare expenses, and they allow families to overcome the original budget restrictions, and facilitate the fulfillment of basic needs of the families. But they are positively associated with excessive healthcare expenses.

Table 5 presents the PROBIT model estimate to determine the probability of catastrophic expenditure for families that reported healthcare expenses in 2010, according to the definition of “expenditure” given at the beginning of this paper.

Three estimates were made in this study: the first, considering the characteristic socioeconomical variables of the healthcare expense estimation models. Later on, the variables related to government contributions and foreign remittances were added. And, finally, a third model was estimated to include the current income variable, and determine its influence on the probability of catastrophic expenditure in families that usually have healthcare expenses.

In the first model (1), excepting the Elderly and Medical care\_variables, the rest showed acceptable statistical significance, and the expected sign. They kept their sign of the previous study; this is, insurance reduces the possibility of catastrophic expenditure, and affiliation to Seguro Popular increases it, even if not significantly.

According to these results, female heads of household reduce the possibility of catastrophic expenditure; and it is also reduced with a high education level of the head of the household, the number of men or women in the family, and when the family has an established home, with proper public services. Only the age of the head of the household, and affiliation to the Seguro Popular, seem to increase the possibility of excess healthcare expenses.

Insurance is fundamental for the reduction of healthcare expenses, but it does not seem to be a determinant of the possibility of catastrophic expenditure.

If we add the variables related to external financial aid, the influence degree of the model is raised, fundamentally preserving the signs, significance, and magnitude of the impact of the rest of the variables. Remarkable is the strong influence that foreign remittances and governmental monetary transfers have on the probability of incurring in catastrophic expenditure.

Table 5: Results of the PROBIT model

Variables	Observations 14088-27655 (n = 13061) Dependant variable: GC_D		
	(1)	(2)	(3)
Constant	-1.5994 ***	-1.6655 ***	-1.6788 ***
Medical care_D	-0.0607	-0.0603	-0.0593
Seguro popular_D	0.1151 **	0.0988 **	0.0979 **
sex. M=1	-0.0948 *	-0.0956 *	-0.0957 *
Age	0.0125 ***	0.0111 ***	0.0113 ***
Formal_ed	-0.0379 ***	-0.0294 ***	-0.0273 ***
Men	-0.0551 **	-0.0611 **	-0.0610 **
Women	-0.0525 **	-0.0654 ***	-0.0655 ***
Elderly	-0.0412	-0.0371	-0.0353
Roofing_	-0.0976 **	-0.0726	-0.0714
Water_	-0.1682 ***	-0.1215 **	-0.1193 **
Remittances_		0.2126 ***	0.2124 ***
Gover_contrib		0.1867 ***	0.1846 ***
Current income			0.0000

Source: Estimate based on figures from ENIGH-INEGI, 2010.

The results have many interpretations; but herein we only want to highlight the strong link between variables, which may be due to the bias towards poverty characterizing these actions. Finally, the model did not suffer significant modifications with the addition of the current income variable; the value of the current income coefficient is zero, and it is not a significant variable. Combining this result with the previous one, simulations suggest that poverty seems to have no incidence on the probability of excessive familial healthcare expenses, but it is a problem that is present all along the societal income structure.

Lastly, households that receive governmental aid, and foreign remittances, tend to allocate part of this income to healthcare expenses, which adds an important element to the funds channeled by the government to the different programs destined to tackle poverty, as well as to foreign remittances, as part of the budget destined to healthcare financing.

## CONCLUSIONS

In this study, we made estimates about catastrophic healthcare expenses, and tried to link their incidence with family insurance and the sociodemographic variables that may define some characteristics of families susceptible to these events.

Catastrophic healthcare expenses pose a risk for families because they can lead to poverty, and the increase of morbidity and mortality in society. A family whose material living conditions are affected by excessive expenses in medical treatment and care, due to the high cost of those services and the lack of public and private insurance, may be obligated to change their consumption and livelihood patterns; and this, in the long run, could generate conditions that favor health problems.

We found that, in Mexico, more than half of the households report any kind of healthcare expenses. But only 2.6% report expenditure levels that could be considered a risk for the financial stability of the families. Considering only half of the family that incur such expenses, the percentage of families exposed to financial catastrophe increases up to 5.3%. In both cases, considering the net income from government contributions and foreign remittances, the incidence of catastrophic expenditure seems to be reduced for the group falling within the definition of CE ( $> 0.30$ ), but the non-affordable category increases ( $< 0$ ). Considering both categories as CE, this results in an increase to 15.2% in the incidence of this kind of expenditure on families that have healthcare expenses.

These results can be explained by the low government expenditure in healthcare; but other scholars, such as Barraza, et.al. (2002), have found that deficiencies in financing, resource distribution and use, as well as in healthcare system organization, can also play a significant role. This situation has originated proposals from international organizations, expert groups, and individual researchers, to reform the Mexican healthcare system; and a central aspect of these proposals is economical analysis and assessment.

Regarding the calculation of the determinants of healthcare expenses, the use of the censored Tobit model allows for more precise estimates, because it excludes the observations located at both ends of the considered sampling interval. The estimates about the determination of healthcare expenses confirm that a reason for the increase in this type of expenses is the lack of registry in the public health system. But affiliation to the Seguro Popular program does not seem to have a similar impact, even though that was the initial purpose of the program. This difference is explained by the low service coverage offered by the program in comparison with the traditional system. The problem is also worsened by aging and, in the open population, by the precariousness of the houses where the families live. If we only consider the population demanding healthcare services, besides healthcare system coverage, other factors that reduce the probability of catastrophic expenditure are formal education and female household leadership. But the consideration of the importance of external aid to the familial income revealed itself as crucial for the increase of healthcare expenses. Combining this result with the descriptive analysis of the catastrophic expenditure estimates, more than a causality link, we see that this association reveals the connection between the incidence of illness, or the acquisition of medicines or healthcare services, and the reception of this type of income.

To clarify this relationship, which suggests a link between poverty and CE, a Probit estimate was applied to the income data, and not on the expense data, as in the censored Tobit model. Even though, in general, this estimate partly revalidated the results obtained by the first model, the obtained results suggest that there is not any relationship between income and the probability of CE. The problem of excessive healthcare expenses is observed all along the income distribution structure, and does not concentrate only on the poorer segments.

Behind the dispersion of the results is the economical reality that catastrophic expenditure, whatever their absolute amount is, represents fi-

nancial bankrupt situations for families. To overcome these economical problems, people have to rely on external financing, be it from relatives living elsewhere, friends, or donations from charity organizations.

These relationships remain hidden if we only consider the total income variable to estimate CE, as suggested by the extant literatura, and not the total income variable, because, in practice, only considering expenses implies disregarding the problema of the financial viability of households affected by health contingencies that must be paid for.

Unlike in the results obtained with the first model, estimated with income data, in this estimation, the probability of catastrophic expenditure does not seem to be affected by insurance; and this is worrying, because it cannot be confirmed that the universalization of healthcare services would solve the problem of catastrophic expenses. This result suggests that there are other determinant factors for CE, which were omitted in the models presented by this study; such as the presence or lack of social security in vulnerable families where health problems attacking the sole economical support of the family can cause undesirable economic difficulties. The absence of family protection plans against health ailments of the head of the family, or the insufficiency of retirement, disability or widow payments, originate a risk of catastrophic expenditure due to illnesses that could be managed by health institutions.

Supported by the political theory of public expenditure, the difficulty of adding preferences in a society with an elevated income inequality, and a balance solution based on the choice of the median voter, the public health offer will not match societal demand. The public expenditure required for an universal health system, which prevents families from going in financial bankrupt due to excess healthcare expenses, would demand a raise of the tax burden, which society itself would refuse to pay.

In political debates and the media, the universalization of healthcare is characterized by the portability of the different sector subsystems, and financed by *lump-sum taxes*, such as increased VAT. Nevertheless, given societal heterogeneity, healthcare system coverage can be reached through a solution that comprises public and private institutions, including private insurance companies, and the payment of healthcare service fees.

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